HALLUCINATIONS

By William A. White, M.D.,
OF WASHINGTON, D. C.,
SUPERINTENDENT GOVERNMENT HOSPITAL FOR THE INSANE.

Since the time of Esquirol,[1] illusions and hallucinations have been sharply distinguished. The former being "the false interpretation of external objects," the latter "subjective sensory images," conditioned centrally without the operation of an external stimulus. This distinction is so readily made by language that—given the definition of illusion—that of hallucination presents itself as a corollary, and no one seems to have doubted that the difference so readily and accurately expressed corresponded to an actually existing state of things. Taking for granted the correctness of their definition, psychologists and psychiatrists have vied with one another in their attempts to explain hallucinations. As a result, we are overwhelmed with theories of all degrees of probability, supported by arguments of more or less doubtful coherence and reinforced by classifications and finely drawn distinctions.

Let us turn to our authorities and find what they consider an hallucination to be. Griesinger[2] says: "By hallucinations we understand subjective sensorial images, which, however, are projected outwards, and thereby become, apparently, objects and realities;" Tuke,[3] that they are "Sensations experienced, although no external objects act upon the periphery of the sensory nerves"; Von Krafft-Ebing,[4] that "Hallucination is the result of an excitation of the central apparatus of a sensory nerve by an adequate ideational stimulus sufficient to give the force of a sense-impression to the answering excitation, which is projected outwards;" Kellogg[5] writes, "An hallucination is the void conscious revival of a sense-impression without a physiological peripheral stimulus," and so on indefinitely.

The common feature of all these definitions is the essential part of Esquirol's distinction, viz.: that the hallucination is centrally originated, that it is an idea or memory image, intensified and projected outward, *i. e.*, become a sensation.

This theory is founded upon a complete misconception of the mental state in hallucination and of the nature of sensation. It is absolutely impossible for a centrally aroused idea to be mistaken for a sensation. The most characteristic feature of a sensory impression, in fact, the very feature which stamps it as such, is the feeling of objectivity, of externality that goes with it, and no centrally aroused idea can acquire in any way this feeling. In other words, an idea of a sound cannot by any possible increase in intensity actually become a sound. As Meynert[6] well says: "The mnemonic image of the most terrible burn is not to be compared in intensity, as regards its effect on the skin, with the faintest touch of a feather. The mental picture of the sun's bright disc has less to do with an impression of light than the least conceivable fraction of the glowworm's faint radiance. The ear-splitting roar of a cannon as a mere image in the memory has less power to affect the sense than the immeasurably minute sound of a hair falling upon water." And as Griesinger[2] acknowledges: "The patient really, and not merely thinks that he hears, sees and smells."

To account for this feeling of externality and projection outward of the hallucination, and also for certain cases where the sense organ itself appeared to be involved, an addition to the above-described theory was evolved, whereby it was assumed that the sensory channels became the seat of a centrifugal nerve current, originating in the higher ideational cortical centers, and following thence to the sensorium, and from there on downward in many cases to the sense organ, where the conditions present indicated a local disturbance therein.

It is a sufficient criticism of this theory of centrifugal conduction to say that it is founded upon a purely gratuitous assumption. No adequate proof has ever been offered that a sensory nerve can conduct in other than a centripetal direction. Bert's classical experiment of grafting the end of a rat's tail into the middle of its back, and then, when it had grown fast, cutting it off at the root and finding that it was still sensitive, proves nothing. It is true that this fact might be explained on the assumption of a reverse current in the sensory nerve, but it could equally well be accounted for by the theory that the motor nerves had assumed sensory functions.*

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* These two explanations do not exhaust all the combinations which can be conceived of as being possible. During healing it is not probable that everywhere a sensory nerve united with another sensory nerve and a motor nerve with a motor nerve. Sensory and motor nerves may have united with one another, and again it is possible that some new nerve channels may have been formed. There is no evidence on these points.

In addition to these two theories, the "central" and the "centrifugal," we have to note that certain authors have endeavored to explain hallucinations by centripetally conducted nervous impulse. As Parish[7] says, however, "Most of the writers who support this view seem more or less alive to its bearing on Esquirol's distinction between hallucination and illusion, but so bred into the bone is this time honored distinction that they do not at first so much as attempt to discover whether there are really any hallucinations in Esquirol's sense at all. They simply take them as proved, and proceed to set up new categories. Schlager,[8] for instance, distinguishes not only between hallucinations and illusions, but creates another class, abnormal sensations, strictly so called, which he endeavors to explain, speaking of olfactory cases, through polypoid growths in the mucous membrane of the nose, through concussion of the brain, apoplectic attacks, etc., that is to say, through inadequate stimuli. Whilst he was able to observe numbers of these phenomena, he could not succeed in meeting with any genuine hallucinations at all. Lazarus[9] considers that in hallucination the sensory nerves are stimulated throughout their course to the center by internal processes, but he creates a new class, "visions," which he explains on the psychical theory.

It is plain from this hasty review of the various theories which have been advanced to account for hallucinations that every possible locale has been considered as the place of their origin. Both the "central" and the "centrifugal" theories we have found good cause for rejecting. It remains, however, for us to examine the "centripetal."

Aside from the theories of Schlager and Lazarus already mentioned, who merely avoid the main issue by creating new classifications, we have the more modern theories of Binet and James. Binet,[10] by a series of experiments with suggested hallucinations, concluded that in every case the hallucination was associated, built about, as it were, some object of the environment—the so-called *point de repère*—and that this was essential to give the sense of objectivity to a suggestion. James, on the other hand, assumes the existence of a centripetal current, be it ever so weak, and this "bucket theory"[11] is an elaborate attempt to explain the cellular dynamics of hallucination. To quote his own words: "When the normal paths of association between a center and other centers are thrown out of gear, any activity which may exist in the first center tends to increase in intensity until finally the point may be reached at which the last inward resistance is overcome, and the full sensational process explodes." "Whenever the normal forward irradiation of intra-cortical excitement through association-paths is checked, any accidental spontaneous activity, or any peripheral stimulation (however inadequate at other times) by which a brain center may be visited, sets up a process full of sensational intensity therein."

It will be seen from these statements of the theories of Binet and James that the former has devoted his energies to the environment, the latter to the cellular processes of the brain. No one thus far has seemed to consider the sense organ itself worthy of much attention. It is true that here and there an investigator has called attention to the condition of the sense organ in hallucinations, particularly Schlager, before mentioned, and Hoppe.[12] There does not, however, seem to be any unanimity of opinion as to the origin of hallucinations among investigators, but, on the other hand, a generally prevailing tendency to accept Esquirol's distinction.

Within the past few years the knowledge of the several sense organs has been materially added to, especially the knowledge of their. various diseases, and coincidently a greatly improved technique of their examination has been developed. The time, therefore, seems ripe for a systematic study of the end organs in hallucinated patients, with a view of determining just what relation, if any, exists between their states and the condition of hallucination.

With this idea in view I began, sometime since, at the suggestion of Dr. Sidis, and with the assistance of Dr. Daly, a systematic examination of all hallucinated cases as they came to my attention. Owing to circumstances over which I had no control my work had to be discontinued, but Dr. Sidis has recently published[13] the results of his labors along the same lines, and I feel that the time is ripe for calling attention to what has been accomplished and illustrating the new theory which has been developed by a few of my cases, although I realize that they were not studied as carefully or as thoroughly as would have been desirable.

This theory of Sidis' may be called, as distinguished from the other theories of hallucination, the peripheral theory—a paradoxical expression from the standpoint of the definition of Esquirol. It is based upon the assumption that perceptions of any sort, whether of external objects or hallucinations, must have a peripheral, a sensory origin to account for that feeling of externality, objectively that I have already called attention to.

A short inquiry into the nature of perception is, however, necessary to understand the method by which peripheral stimuli can produce hallucinations. I see an orange before me on the table. I see that it is round, at a certain distance from me, and of a certain consistency, smoothness, size and weight. The image cast upon the retina is simply that of a round, variously shaded patch of yellow; the perception of distance is due to the sensations derived from the ocular muscles in accommodation, convergence of the visual axes, etc., while the perceptions of roundness, smoothness and weight are inferential from previous tactile and kinesthetic sensations. These associated elements in the perceptions are, however, very different from ideas, or memory images. The element of weight, for instance, is quite distinct from either the abstract idea of weight or the memory of the weight of previous oranges. The weight can, apparently, be actually seen and thus forms an organic part of the percept orange.

In illustrating this point Sidis says: "In seeing a lump of ice we perceive its whiteness, its transparency, its hardness, its smoothness, etc. These elements seem to be given directly in sensory experience. They seem to be directly perceived and still are qualitatively different from the hardness, smoothness and coldness, as given directly by the experience, when the hand gets hold of a smooth lump of ice. The sensory elements are determined and colored by the central visual sensory elements. The sensory elements of coldness, hardness, smoothness are of a visual character.

"It is usually claimed that such additional elements that are not given directly by the stimulated organ are elements representative in character, derived from the memory. This statement is not quite correct. In seeing the piece of ice the hardness and smoothness are not re-presented, they are *presented* to the eye; we really seem to see, to experience these sensations going to make up the percept ice. It is not true that on catching sight of a whitish, transparent, glittering lump we remember that it is also hard, smooth and cold. The whole percept with all its sensory elements appears at once in the synthesis of the percept ice—we see, we perceive the hard, smooth, cold ice. The hardness simply remembered is altogether different from the hardness perceived in the seeing of the lump of ice."

What happens then in normal perception is that the sensorium is excited primarily by the particular form of sensory stimulus, brought in by the acting sense organ, and, secondarily, by the irradiation of this stimulus into adjacent sensory fields. The percept receives its specific sensory quality—visual, auditory—from the nature of the primary, focal sensory stimulus, and is made complete by the added secondary elements.

Now, all that we have to conceive to explain the phenomena of false perception is the shunting of the main current of the sensory stimulus into the adjacent sensory fields, thereby arousing the secondary sensory elements to undue intensity, so that they occupy the sensorium on an equal footing, or, perhaps, to the exclusion of the primary elements.

The phenomena of secondary sensations, the so-called sound photisms, light phonisms, pain photisms, etc., have been known for a long time, and are not particularly infrequent. Bleuler and Lehmann[14] found them present in one form or another in 76 persons out of a total of 596, *i. e.*, 12½ per cent. In most all of these cases, however, that have come to my attention the primary and secondary perceptions are both present in consciousness, and the patient usually has not serious difficulty in distinguishing the false perception. Sidis has been the first to apply this theory of secondary sensations to the explanation of hallucinations, and the following cases will illustrate how the phenomena as ordinarily experienced can graduate into a true hallucination.

*Case I.**—Mrs. J., aged twenty-five years, in good general health, complains of naso-pharyngeal catarrh and tickling in throat causing cough. She has deflected septum and enlarged lingual tonsils. Operation upon these and subsequent application of ordinary styptics have been accompanied by the odor of almonds, located on the side of the nose.

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*Cases I and II communicated by Dr. R. R. Daly.

Case II.—Mrs. B., aged twenty-eight years, complains of having a bad odor in her breath, which seems most acute to her in her nose. Her friends tell her that they cannot detect any unpleasant odor. She seeks special medical advice because she appreciates this odor and suspects friends of being too courteous to tell her of it. She is in good general health with slight hacking cough and tendency to clear throat.

Examination shows the nose to be in normal condition throughout, the nasal vaults are unusually accessible, thus leaving no doubt as to their healthy condition. Pharynx and larynx also normal.

The nostrils were alternately plugged, the lips closed, and air from each nostril and the mouth tested separately. Not the slightest odor could be detected, though she appreciated it herself as being very disagreeable. Two small lingual tonsils were more closely examined, and upon the posterior .side of each a minute morsel of food was found. This was removed, but on examination was found to have absolutely no odor. It had not undergone sufficient change to disguise its character—it was bread. Shortly after its removal the bad odor grew less. Both tonsils were at once removed, and the patient sent home. At the end of two days all odor had disappeared. At the end of four days there was still no odor, but it was induced by touching the neighborhood of the tonsils by a small pledget of cotton carrying a weak solution of citric acid. At another time it was induced by a very weak faradic current. The odor had not reappeared at the end of six weeks, except by stimulating the taste goblets, and the patient was entirely relieved of the hacking cough.

This latter case was truly hallucinated by a secondary sensation although she was not insane. It can be readily seen, however, how such a phenomenon, occurring in a predisposed individual or in one already over the border line, might soon form the focus of well-marked persecutory delusions.

Case III.—D. C., a young woman admitted to the hospital with an acute psychosis of the confusional type, with dream-like hallucinations, both visual and auditory. She saw all sorts of visual images, processions of soldiers and the like, and also heard voices. After recovery said that the figures she saw were in motion, and the principal direction of their motion was downward, so that she had to strain to keep them up in the visual field; also saw patches of light, which moved by preference to the right.

Examination shows vision 20/20 for both eyes, with slight astigmatism and slight photophobia with somewhat abnormally red retinal reflex. Septum slightly deflected to left into middle meatus.

Right middle turbinated is bullous and impinging on septum. There is a sub-acute catarrhal naso-pharyngitis, probably following diphtheria, which she has had three times. Ears show slight retraction of drum membrane, with slightly shortened cone of light in each side.

Stimulation of the retina by having patient look at light of an Argand burner produced sound as of ringing bells, which lasted 42 seconds after the light was turned off and eyes shut. In trying this experiment again the sound developed in 27 seconds after the stimulus was applied, and had ceased in 22 seconds after it was withdrawn.

In this case the motion of the visions would indicate that they were due to muscæ volitantes. Particularly is this indicated by the straining effect required to keep the images within the visual field. There is present, however, a well-marked catarrhal condition of the pharynx with abnormalities of the septum and right middle turbinated, which have resulted in a moderate grade of middle ear disease. There are also present on experimentation elementary light phonisms.

The sensory falsifications probably took their origin in the extremely sensitive eye from the misinterpretation of floating bodies in the vitreous. The patient seeing these bodies against the light walls and ceiling of the room as she lay upon her back. The constant stimulation of these sensitive eyes brought about the light phonism which were interpreted as voices, the auditory centers being in an especially susceptible state, due to the summation of stimuli from the abnormal end organs.

The following case I was able to experiment with somewhat during the time she was hallucinated. It shows some points of interest:

Case IV.—G. E. M., female, married, passed menopause. Diagnosis, paranoia. Her mental alienation is stated as having originated about one year ago, when she lost her older daughter, to whom she was deeply attached. At this time she became much depressed and suffered from considerable gastric disturbance, so that it was some weeks before she rallied and was able to take much food. Her mental trouble all along has been much aggravated by her husband, who, although he provides liberally for his family, causes her much concern by indulging to excess in alcohol periodically.

At present she claims to be able to see visions of the spirit world. She is continually surrounded by spirits, and can always see them and believes firmly in their reality. The origin of these hallucinations, she explains, was from her intense desire to see again her dead daughter, of whom she has no picture. Since she first saw a vision of her daughter, however, many other spirits have appeared to her, in fact, she says that she has had visions from time to time ever since she was a child. She has lately suffered much from some of the spirits who she thinks are evil in nature. They keep her awake nights and bother her with pains in different parts of the body, etc. She has never been able to communicate with these spirits, but of late has occasionally heard them speak a few words, and these words are usually heard in the right ear.

An examination disclosed that her vision was apparently quite good for one of her age. She was asked to fix her attention on the spirits about her and describe how they looked. She did so, and it was noticed that she closed her eyes. In reply to a question she said that she usually saw the spirits better with closed eyes. An examination of the hearing disclosed that with the right ear she could only discover the ticking of a watch when the watch almost touched the ear. With the left ear she could hear the watch tick about 37.5 cm. distant.

The aurist who examined her ears some time ago told me that she had some catarrh of the middle ear, but beyond this there was some "nerve trouble."

An examination of the eyes was made by my advice. Atropine was put in them for the purpose of making this examination. Her attending physician then at my request observed the effect upon her visual hallucinations. He tells me to-day that so far as he could observe no effect was produced, that the hallucinations were as clear as ever. This certainly strongly negatives Binet's *point de repère* theory.

My experiments in this case consisted in the main of stimulating the auditory nerve in various ways—by talking, reading, singing and the use of the tuning forks. When the experiments were commenced the spirits *were seen very indistinctly*, only the general outline was visible and not the faces; after the experiments had been continued a short time the *spirits' faces could be seen,* and wore an expression of interest, and after a still further interval, during which I continued to apply auditory stimuli, the patient said that the *spirits were more numerous* than at first and they *came nearer to her.* It was found also that relaxation of the accommodation would cause spirits to appear in the visual field.

In this case there is direct evidence of the effect on hallucinations in one sensory field of stimulation of the sense organ belonging to another sensory field. It is also noteworthy that the visual hallucinations could be brought about by relaxing the accommodation, and that the auditory hallucinations—voices—were usually heard in the right ear—the one more seriously affected.

But the occurrence of secondary sensations, such as described in the foregoing cases, are perhaps not the usual ways in which we see hallucinations manifest themselves. In the cases cited thus far there have been evidences tending to show that the sensory current arising in the periphery was shunted, to a greater or less extent, into another sensory field, as in Cases I. and II., taste olfactisms; in Case III., light phonisms; and in Case IV., sound photisms. It is more usual to find, however, that the secondary sensations that go to form the hallucinations arise in the same sensory field as that in which the hallucination is perceived, and its origin is then found to be dependent upon stimulation of the corresponding sense organ. Thus the humming, buzzing, singing subjective sounds of otitis media give rise to the hallucination of voices or floating bodies in the vitreous are seen as faces and the false perceptions—rather illusions than hallucinations in the sense of Esquirol—are said to be of entotic or entoptic origin, as in the following cases:

Case V.—D. F., female, age forty-three, diagnosis paranoia. Came to hospital with history of persecutory delusions and auditory hallucinations, and is said to have threatened suicide. The principal delusion she had on admission, and the one that has persisted ever since, is that there were "talking machines" on her head, and she was continually annoyed by them. She says she frequently hears voices talking to her and can understand what they say. She has heard these voices for a long time, but of late never hears them unless she lies down, although she says that before coming to the hospital she used to hear them while up and about and engaged in her ordinary household duties.

Patient thoroughly believes in the reality of these voices. She also has vague persecutory delusions connected with what she sees. She will cover up her head when lying in bed to shut out the sight of those who walk by her room door. Every motion such persons make, as, for instance, scratching the head, putting the finger to the mouth, etc., is interpreted as having some reference to herself. The exact significance of the signs, however, she does not know. She says, further, that she does not enjoy entertainments because every one there knows what comes into her mind. People know her thoughts as soon as she thinks them. The machine that used to be put on her head read her thoughts. She used to stuff a handkerchief into her mouth to prevent herself from talking so others could not know her thoughts. She says she must have said things, for she often felt her lips move, but tried to prevent them from moving, as above, but could not. When her lips moved she talked. She does not intend to talk, but the first thing she knows her lips move and every one acts as if she had said something that was not right.

As patient stated she heard voices usually only when lying down she was requested to lie down, first on one side and then on the other, and it was discovered that the voices were only heard in the under ear; the ear which was closely applied to the pillow. In this position she heard a man and woman crying—they sounded like her brother and sister. She also heard the sentences: "Nobody to blame but yourself," repeated by a woman's voice, and "Johnny is here."

She heard both the crying and the words at different times in each ear. While she was hearing the sentence, "Johnny is here" being repeated, she was asked to press the tragus of the ear in which she heard the voice well down upon the entrance to the auditory canal and observe the result. The voice was just as distant as before, but appeared to be somewhat differently located.

From time to time this patient has complained that something was placed in her food. In answer to inquiries concerning this point she stated that she was led to the belief because, after partaking of a meal, her mouth was dry and smarted and tasted bitter. She did not have this bitter taste while eating, only afterwards. Examination showed her to be able to distinguish ordinary tastes (sweet, sour, bitter and salt). Her tongue, however, was coated and her lips dry, and while being examined she stated that she had that same smarting feeling in her mouth which she described as having led her to the belief that something was in her food, although it was fully three hours after her last meal. She had no idea that she had been poisoned, but thought that medicine had been given her in her food.

Naso-pharyngeal and aural examination gave the following results:

Nose.—Perforation of septum 1 cm. in diameter through the cartilaginous portion.

Naso-pharynx.—Chronic inflammation of mucosa of the vault and posterior wall with hypertrophy about both Eustachian tubes.

Ear.—Complains of ringing in the ears but not as much as formerly. Has vertigo, which comes on suddenly. She describes this by saying she feels as "if the side of the house was coming toward me and I have to lie down," and feels as "if drunk and I must steady myself." There is no history of pain or injury or sign of abscess or discharge.

Inspection of the external ear shows retraction of both membrana tympani. The right cone of light is shortened by one-half, the left by two-thirds. On the left side the membrane is attached to the promontory of the malleus.

On both sides Shrapnell's membrane is thickened and opaque. Weber's test gave better hearing in the left ear. The Schwabach test gave the following results:

Left Ear.				Right Ear.			
C^4 air	conduction	27	sec.	C^4 air	conduction	16	sec.
" bone	"	8	"	" bone	"	9	"
C^2 air	"	37	"	C^2 air	"	40	"
" bone	"	22	"	" bone	"	21	"
C^0 air	"	18	"	C^0 air	"	22	"
" bone	"	8	"	" bone	"	8	"

The results of this examination, given above, confirm the diagnosis of internal ear trouble together with chronic otitis media. The condition of the naso-pharynx being contributory to the trouble with the ear.

The presence of middle ear trouble is made conclusive by the appearance of the tympanum previously described, this condition either in part depending upon or at least being aggravated by the hypertrophic condition of the mucosa about the pharyngeal terminations of the Eustachian tubes interfering with the ventilation of the middle ear. Weber's test indicates merely that the two ears are not alike. Schwabach's test, on the other hand, indicates a trouble deeper seated than the middle ear, namely, a disorder of the auditory nerve itself. This is shown by the marked reduction in the length of time the different tuning forks are heard, and also in the reduced ratio of bone to air conduction, especially for the upper and lower limits.

The vertigo from which this patient suffers can safely be put down as due to internal ear disease. While it is true that vertigo does occur with otitis media it is here rather an episodic phenomenon than a constant feature. Tinnitus, when persistent and of long duration, may also safely be considered as evidence of internal ear disease. Even when associated with otitis media it is probable that it indicates functional disturbance of the labyrinth.

We have discovered, then, by our examination of this case, unequivocal signs of a chronic disease of the middle and of the internal ear. A disease which must of necessity maintain the end organ of hearing—the terminal filaments of the auditory nerve—in a constant state of irritation, which irritation we have every reason to believe manifests itself more or less continuously by tinnitus aurium. It is significant, however, that this patient does not complain of a ringing, buzzing, humming or roaring sound in her head, but she does complain of the "talking machines" and of hearing people crying and of the human voices that constantly address her. If this patient is misinterpreting the ordinary sounds of a tinnitus aurium, and attributing to them the qualities of the human voice then we should expect to find that anything which tended to produce or aggravate the tinnitus would produce the characteristic auditory false perceptions. This we find to be the case. When the patient is asked to lie down and closely apply one ear to the pillow—a position calculated to produce tinnitus, if not already present, or to aggravate it if pre-existent—she immediately complains of hearing a man and woman crying, and also the sentences, "Nobody to blame but yourself," repeated by a woman's voice, and "Johnny is here." These sounds and sentences are only heard by the ear applied to the pillow, whichever one that may be.

In this connection the patient's own testimony on the subject of subjective noises is interesting. She says she used to have a great deal of singing in her ears, but that she has not nearly so much now. She used to think that the spirits produced this ringing. At present the most common subjective sound, aside from actual voices, is a humming. This humming, however, she attributes to human agency. The tendency to delusional explication and misinterpretation of subjective sounds is here clearly brought out.

We have proved in this case, beyond a reasonable doubt, that the origin of this patient's auditory hallucinations is in the end organ of hearing. That the condition of irritation to which the terminal filaments of the auditory nerve has been subjected has been sufficient to produce subjective sensations of the specific character for which that nerve is specially constructed, and that these sensations, arising in this manner, have been falsely perceived by the patient.

A similar condition exists in the next case.

Case VI.—M. D., female, married, about 45, diagnosis paranoia, She is kept awake nights by her enemies. They followed her from S—— here, and live on G—— Avenue, city of B——. Their object is to do her all the injury they can and they constantly bother her by "yawling and bawling" through the floors and the walls. These enemies are friends of a woman who interfered between her and her husband. These voices are heard both day and night, but mostly during the day. She distinguishes the voices of men, women, boys and girls, heard as if coming through the walls or floor. She says she can hear these voices echo way down in her stomach. When the voices annoy her very much she puts her fingers in her ears or presses on the tragus. At night she often stops up her ears by lying on one and putting her finger in the other. Often notices that when she does this she still hears the voices, and so she assumes that they must be talking louder. At times the voices are indistinct, at other times she can understand what they say. It is usually vile, nasty language, which she does not like to repeat. When she hears this and then stops up her ears she has noticed that the words became more jumbled so that she could not distinguish what was said. Thinks that the voices must speak through tubes, inasmuch as she can hear them through the walls and from one end of the ward to the other.

Naso-pharyngeal and aural examination gave the following results:

Patient thinks her hearing has failed for the past two years. Says her right ear seems as if filling up. She attributes this to the pressure on the ear used to keep out the sound of the voices. Complains of occasional attacks of vertigo. It is objective in character and usually occurs when stooping and getting up quickly or in going up and down stairs. Has also had several attacks of vertigo occurring in the morning. When this occurred she kept her bed until it had disappeared before rising. She describes this by saying that she has "a feeling as if I should fall if I were standing." She has ringing in the ears for three or four days when she has a cold in her head. On examination she denied having any entotic sounds, but after repeated listening intently she confessed to hearing a slight ringing sound in the right ear.

Naso-pharynx.—There is chronic congestion and hypertrophy of the naso-pharyngeal mucosa, especially about the openings of the Eustachian tubes. Politzerization is accomplished with difficulty. Both inferior turbinated bones are hypertrophied.

Ear.—Left drum membrane cloudy and slightly retracted. Right drum membrane normal.

Schwabach's test gives the following:

Left Ear.					Right Ear.				
C^4	air	conduction	17	sec.	C^4	air	conduction	20	sec.
"	bone	"	10	"	"	bone	"	13	"
C^2	air	"	55	"	C^2	air	"	47	"
"	bone	"	25	"	"	bone	"	15	"
C^0	air	"	30	"	C^0	air	"	30	"
"	bone	"	10	"	"	bone	"	8	"

This table shows diminished bone conduction, especially on the right side, and taken in connection with the other symptoms in the case indicates beginning degeneration of the filaments of the auditory nerve in the internal ear.

During examination I had her hold her hands over her ears, and each time she heard voices. These voices each time were heard as if coming from her right, although she said she heard them in both ears. It is significant in this connection that she usually lies on her right side at night, and that at this time the voices seem as if they came from behind.

Both of these cases show quite clearly that the *origin* of the false perception was due to a pathological process in the end organ. This much is necessary to stamp the experiences with the feeling of subjectivity—of having arisen in the environment. The specific elaboration of this sensory material into perceptions of voices is what is attributable to the central nervous organs.

A wave of consciousness is composed of many elements—presentative and re-presentative, and the sensory elements are both primary and secondary. Normally the focal point, or point of clearest perception, is occupied by the primary, not the secondary sensory elements. Thus in looking at a painting of a beautiful landscape it is the visual perception of the blue sky, the winding river, the green grass that are focal, and not the rippling of the river over pebbles, or the lowing of the cattle pictured in the foreground. These elements in the perception, the secondary sensory elements, are marginal, they do not reach the intensity of the others unless the attention be directly centered upon them to the exclusion of the primary elements.

Just the opposite state of affairs exists in our patients. Neither patient complains of tinnitus, but experiments clearly demonstrate that they both have it, and also that conditions which influence the tinnitus also influence the hallucinations. Normally the primary sensory elements, the tinnitus in these two cases would occupy the focal point of the wave of consciousness, but here we see that they have sunk to a position of marginal value, and the secondary elements have risen in their place, so that an actual effort of attention is required to appreciate the tinnitus at all. In these cases the secondary elements have arisen in the same sensory field as the primary, while in other cases the primary and secondary elements may arise in different sensory fields, as, *i. e.*, in Case IV., the primary elements are auditory, the secondary visual.

A similar condition of affairs is shown in the gustatory field in Case V. The false gustatory perception leading to the belief that medicine was placed in her food being quite clearly due to the condition of the mouth and tongue.

The next case presents false perceptions in both gustatory and olfactory sensory fields.

Case VII.—Claims that she smells and tastes blood of people who are killed here. Blood is smelled when the cooking is going on in the kitchen and the odors from there permeate the ward. The blood is tasted at meal time when stews or sausages are being served. Not a case of hallucination.

Throat, nose, tongue, etc., show no abnormal conditions present.

This case is particularly interesting because it is not a case of hallucinations at all, in the sense of Esquirol, but rather, and quite typically, a case of illusions, and yet we see here precisely the same mental process as in one other case, and after all why should we not? It cannot be a matter of vital importance from just what source the sensory stimulus takes its origin, whether from the patient's surroundings or from his end organs, both origins are from a psychological standpoint equally environmental.

The next case illustrates hallucinations of entoptic origin, due to floating bodies in the vitreous, and shown by experiment to be produced also by negative after images.

Case VIII.—M. J. C., female, second attack, diagnosis, melancholia. Has the delusion that she is supernatural. That her body is filled with electricity, that she is a supernatural spirit of evil, that she is lost for the hereafter, and her children would some day awake to the knowledge that they were just like her.

Sees visions. Often sees faces against the wall, and they are then bright. Looked at sun the other day, and they were then all dark. Can sit and look out of window, and in a short time can see faces, sometimes eyes, sometimes a chain of faces, or only at times a lot of black dots. Says she thinks that these visions are impressions she has received at some time and are now projected out. Thinks they could be photographed and magnified.

Looking out of window at faces; they look about the same with each eye separately, but plainer with both eyes.

The visions are often described as chains and move quite rapidly at times. The further away they are the larger they are.

I sketched as near as possible the appearance of floating bodies in the vitreous, and showed it to her; she said that what she saw had a similar appearance.

She was asked to look out of the window until she saw the faces. She did so. Faces were in motion. When she looked up or down, or to the right or left, she saw the same faces. They changed their position with the movements of her head.

The next case illustrates well the intimate relations existing between the sensory stimulus and the false perception on the one hand, and the mental state and thoughts of the patient on the other.

Case IX.—C. W. W., female. Voices different, but all are of Christ. He, however, uses different voices. Voices are internal. Patient used to think she spoke them herself, because it seemed as if her lips moved. She was told to close her lips tightly, and she heard the sounds just the same. She was also told that the voice came from the left side in the region of the heart, and she has a trembling there when she hears the voice (which she does constantly). Voice sounds as if it came from that direction. The reason she never noted them before was that the facts were not revealed to her until December 20, 1899, when she was sick abed and had numerous communications from Christ, and saw visions of husband's head and Christ's hands which were clasped. He said husband's soul was saved. Saw sleeve of Christ's garment and cuff on husband's wrist, also noted quality of goods of sleeve corresponding to what he was laid out in. Has seen same vision since.

Always sees vision at night in bed with eyes closed. Usually seen before going asleep, but often after awakening during night, but always with eyes closed.

Visions of persons and things in motion, when eyes are closed (only), and usually in the dark—illumination good. Also hears voices, laughter, etc., often in connection with visions. *Visions are invariably associated with auditory hallucinations,* if not at their inception, then shortly after.

Left Ear.—Marked retraction of drum membrane; short process malleus and cone of light shortened one-half. Schrapnell's membrane hyperemic and thickened.

Right Ear.—Retraction of drum membrane, but not so much as left ear. No hyperæmia of Schrapnell's membrane.

Nose.—Negative.

Throat.—Chronic naso-pharyngitis and thickening of mucosa about both tubes.

Weber heard better left side (C^1)

Watch tick, left ear, 54 in.; right ear, 48 in. Voice said she answered just right after completion of above experiments.

Schwabach.

C^4 air	L. E.	20 sec.	C^4 air	R. E.	22 sec.
C^4 bone	" "	10 "	C^4 bone	" "	10 "
C^2 air	" "	60 "	C^2 air	" "	45 "
C^2 bone	" "	31 "	C^2 bone	" "	29 "
C^0 air	" "	37 "	C^0 air	" "	28 "
C^0 bone	" "	24 "	C^0 bone	" "	11 "

Said that heard voices while tuning fork was being used in these tests.

Cotton in left auditory meatus, hand held over right, says hears voices tell her she better go see sister-in-law.

Sister-in-law was waiting in reception room for her.

Voice said to tell me that voices did not come from head when C^0 was held to left and C^1 to right ear. Experiment repeated; voice said, "Take your father's advice and do the best you can, and you will come out all right."

Experiment repeated, no voice.

Experiment repeated, no voice.

Experiment repeated, C^0 to left and C^3 to right ear, voice said, "Go right on C—— W—— and answer Dr. White's questions and he will aid you."

Experiment repeated, voice said, "I will help you to answer the questions readily to Dr. White without the tuning forks, they have nothing to do with this case."

Experiment repeated, "He said not a word more as long as uses those, for they are of no avail."

Experiment repeated, voice said, "Ha! Ha! isn't it comical. Dr. White using those." Patient laughed.

Experiment repeated, heard word, "nothing" repeated regularly at regular intervals.

I tried this experiment on myself and the nurse, and found that I had unintentionally been moving the forks, for with my greatest efforts to hold them still the sounds nevertheless came in beats to the nurse's ear.

Experiment; same forks to same ears, but C^3 was regularly withdrawn. Patient said heard word "nothing" continuously and regularly repeated, and when asked to repeat it herself reproduced the same time intervals I had made with the forks.

C^3 air	L. E.	70 sec.	C^3 air	R. E.	74 sec.
C bone	" "	29 "	C bone	" "	35 "
C^1 air	" "	34 "	C^1 air	" "	19 "
C bone	" "	8 "	C bone	" "	10 "

During all experiments heard word "listen" repeated. It is noticeable that the tone of the forks resolves itself in about the same intervals as the word listen repeated.

That the central disturbance is a necessary factor in the peculiar interpretation of the sensory stimulus is shown in the next case.

Case X.—M. M. Diagnosis, acute alcoholic insanity.
Right Ear.—Drum membrane slightly opaque.
Left Ear.—Same, even less.
Nose.—Both middle turbinated bones touch the septum.
Throat.—Normal.
Weber heard longer in left ear.
Schwabach.

C^4 air	L. E.	23 sec.	C^4 air	R. E.	14 sec.
C^4 bone	" "	15 "	C^4 bone	" "	14 "
C^2 air	" "	44 "	C^2 air	" "	38 "
C^2 bone	" "	16 "	C^2 bone	" "	19 "
C^0 air	" "	27 "	C^0 air	" "	24 "
C^0 bone	" "	14 "	C^0 bone	" "	13 "

Schwabach shows with C^4 that air conduction is diminished, indicating otitis media; while C^2 shows general diminution of perceptivity. The nares and pharynx being so clear the hearing is not so good as it should be at her age (about 45).

When this patient was admitted she was suffering from auditory hallucinations and persecutory delusions. These soon cleared up when the above examination was made. The conditions found were similar to those found in other hallucinated cases. Quinine was given in sufficient doses to produce marked cinchonism with tinnitus, but there was no tendency to hallucination. The sounds were appreciated at their true value. The central receiving apparatus had returned to a normal state.

The ten cases cited lead naturally to four conclusions.

First.—Hallucinations are false perceptions. To have a false perception there must be something to perceive, and that something is in the environment and can only enter as a factor into the mental life through the intermediation of sensations. Ideas cannot be perceived.[13] "Were that the case the course of internal and external worlds would have become confused and confounded, man would have become the dupe of his own ideas, the world a gigantic madhouse."

Second.—Hallucinations are secondary sensations either arising in the same sensory field, in which case they might be described as illusions in the sense of Esquirol, or arising in other sensory fields, in which case their secondary character is quite clear.

Third.—The mental state in illusions and hallucinations is identical.

Fourth.—Given the sensory elements the falseness in their perception is due to central derangement.

The several theories of hallucination which have from time to time been exploited, particularly those that attribute their origin solely to centric disturbance with reverse currents in the sensory nerves go a long way around, and take great pains to find an explanation, which in reality exists close at hand. Titchener[15] estimates that there are more than 44,435 elementary sensations, or sensation qualities, appreciable by the various sense organs, and says, "Each one of these forty thousand qualities is a *conscious element,* distinct from all the rest, and altogether simple and unanalysable. Each one may be blended or connected with others in various ways to form *perceptions* and *ideas.* A large part of psychology is taken up with the determination of the laws and conditions which govern the formation of these sensation complexes." Surely with this wealth of material, this abundance of the very elements that go to make up perceptions, it seems hardly necessary to strain a point to look elsewhere for additional material.

True, it often happens that the sensory elements of perception in whole or part have but a marginal or subconscious value. But because they may have been displaced from the focus of clear perception, relatively or absolutely, because perhaps they cannot be replaced except by a special effort, or perhaps not at all, they are none the less real. Many sensations are normally not appreciated at all, either because of their weakness or because of the preponderance of some other sensations. In fact, this is an absolutely necessary condition for mental concentration. If it were otherwise and all sensory impulses were appreciated at their full value, coherent thought would become impossible. The odor of the flowers on my study table is no longer appreciated when I become absorbed in a book, and yet it is quite conceivable that it may enter as a factor into the formation of my mental state at the time.

Thus it is that sensations that under ordinary circumstances would hardly, if at all, rise above the threshold of consciousness, for some reason or other acquire an unusual value, and being thus out of harmony with the actualities they represent, a false perception is the result. This is especially well shown in the phenomena of dream consciousness. Here all manner of sensory impressions which would find no place in waking consciousness find a fictitious value, not because of their increased intensity but because the ordinary sensations that occupy the waking consciousness are in abeyance.[16] "Thus Weygandt dreamt on one occasion that he was looking at 'living pictures' under magnesium light, and found on awaking that the sun had just burst from behind the clouds; while Hammond mentions a gentleman who dreamed of being in heaven and was dazzled by its brilliancy, finding, when he awoke, that the smouldering fire had kindled into a bright flame, the light from which fell on his face." This explanation is particularly applicable to the organic sensations, the coenesthesis which acquire an added vividness in dream consciousness, because of the shutting off of the ordinary avenues of sensation. We all know, too, how easy it is to appreciate sensations from any part of the body when our attention is fixed on that part to the exclusion of all else. Many of the cases with delusions that animals are in the abdomen, the bowels are stopped up, the brains have been removed, can be explained in this way, especially those cases that show a connection between some pathological process as endometritis, chronic gastric catarrh and the like, of which there are so many.

It is necessary, however, in order that the particular sensory stimulus receive the specific interpretation that stamps it as an hallucination that there be a certain state of "preparedness" on the part of the mind. The mind of the patient with tinnitus aurium who hears a voice is especially attuned to respond in that particular way. To the untrained ear the sounds that emanate from a full orchestra constitute one immense, unanalysable volume, but the musician can instantly differentiate the high, strident notes of the oboe, the sigh and wail of the cello, the deep sonorousness of the double bass, and the blare of the horns, and as the music proceeds the slow solemnity of an adagio being replaced by the vivaciousness of an allegretto, the composer fairly speaks forth his thoughts, his feelings, his very soul to the listener. It is the old experience over again of finding what is sought. The student looking into the microscope for the first time invariably sees what the master tells him is there. What wonder then that the paranoiac, harrassed by all manner of suspicions, trusting no one, feeling that all are leagued together to accomplish his ruin, suffering from almost continuous entotic sounds, should sooner or later begin to single out from this constant jumble of buzzing, humming, and ringing the voices of his enemies.

Many more cases might be cited by way of illustration of the various points brought out in this paper which I am afraid is already unduly long. I wish only to add that I have never yet failed to find a peripheral pathological process in all hallucinated cases I have examined which could explain directly or indirectly the hallucinatory phenomena. It is, of course, not necessary that a peripheral process be pathological in order to account for a hallucination, as witness the dream hallucination and the hypnotic hallucination, but it is hardly conceivable that the auditory hallucinations of a paranoiac which are practically constantly present unless the patient's attention be distracted, could be produced by other than a constant irritant, which, of course, would necessarily be pathological in origin.

The necessity of a most careful and painstaking examination of all hallucinated cases is apparent, especially when we remember the multitudinous possibilities of arousing secondary sensations in other sensory fields. Not only sound photisms, light phonisms and similar combinations in the regions of the special senses are known, but the much more obscure region of the coenesthesis is sometimes involved, and Grüber[17] has described colored temperature, colored movement, colored resistance, movement hearing, temperature hearing, resistance hearing and many other combinations equally complicated. With all these possibilities in mind I would be loath, indeed, to accept other than a peripheral explanation of any hallucinated case.

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[14] Cited by Hyslop in "Mental Physiology," Phila., 1895.

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[16] "Sleep: Its Physiology, Pathology, Hygiene and Psychology," by Marie de Manacéine. Contemporary Sc. Series, New York, 1899.

[17] "L'audition colorée et les phénomènes similaires," International Congress of Experimental Psychology, London, 1892. Cited by Hyslop *op. cit.*